State Agency
Annual Energy Usage Report
FY09

Submitted
By:

ARIZONA DEPARTMENT OF COMMERCE

Final report submitted October 2009

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Energy Usage Progress Report

Introduction and Executive Summary

The Department of Commerce, in accordance with A.R.S. §34-451, submits the following report detailing the annual energy savings progress in state buildings. This statute requires three state building systems, the Department of Administration, the Department of Transportation and the Board of Regents, to reduce energy usage in their buildings by 10 percent by July 1, 2008 and 15 percent by July 1, 2011. The baseline year for energy usage per square foot is FY02.

FY04, the first year that this report was required, agencies implemented a considerable number of actions towards meeting the energy saving goals authorized by the legislature. The agency reports showed a **2.5 to 3.0 percent reduction** in energy usage in the first year.

FY05, in the second year of reporting, agencies continued to make strides to reduce energy usage. The Department of Administration (-14%) and the Department of Transportation (-9.9%) report reductions **above or near the mandated 10 percent reduction by 2008.**

FY06, the third year of reporting saw some agencies reaching a plateau, where some of the easy energy saving actions had been exhausted. Compared to year two, year three had 11% more cooling degree days which significantly cut into the previous year's savings.

FY07, in the fourth reporting year, one agency has surpassed the 10% savings goal and others are approaching the goal.

- The Arizona Department of Emergency and Military Affairs (DEMA) has successfully reached the 10% reduction mandate and now stands at **12.6% below** their FY02 level. With cooperation from their Department of Defense partners, DEMA was able to make over $1,000,000 in energy improvements to their facilities to reduce energy usage and to improve the energy security of their facilities. DEMA added 10 kW of photovoltaic panels to increase their system capacity to 50 kW.
- Closing in on the 10% mandate, the University of Arizona (UA) energy usage per square foot of space is **down 9.3%** from the FY02 period. Arizona State University (ASU)'s Tempe Campus has **reduced** energy usage **by 7%**. Both universities have completed energy saving performance contracts to improve the efficiencies of all of their facilities on campus.

FY08, on an individual agency basis, the DEMA is the only agency to meet the 10% reduction.

- DEMA has reduced their energy usage by 10.2% below their FY02 usage. With a full time Energy Manager and assistance from their federal military branches, they have achieved remarkable results.
- At ASU's Tempe Campus, energy consumption is down 7.7% from their FY02 usage. The Department of Corrections, ADOT and NAU were able to achieve 6.4% reductions. Other agencies and university campuses had savings of under 5% and have a ways to go to reach the 10% reduction mandate.

FY09, there has been a dramatic reduction in energy consumption. Three factors seem to be at the root of the savings success. First, agencies and universities have taken actions to reduce their energy consumption. Examples include: ADOT down 18% attributed to a two-year campaign convert all lighting from T12 lamps to T8 lamps, installing over 350 programmable thermostats and replacing 44, old and inefficient packaged cooling equipment. The Department of Corrections entered in to an energy saving performance contract at their Tucson facility and it may have contributed to the department's overall 14% reduction. The second reason for the reductions is the weather. Cooling degree days for FY09 were 6% lower than FY02. Heating degree days were 18% lower than the FY02. FY09 was an unusual year

where savings could be achieved due to weather conditions on both the cooling and heating side of the equation. And the third reason for the drop in consumption, is an economic one that is difficult to quantify, it is the reduction in the number of employees in state agencies and the universities. There is energy consumption associated with every employee position. There is the direct plug load usage of computers, printers, copiers, desk lights. And the hard to measure energy usage of employees; impact on heating and cooling systems, office lighting, hot water, elevators, and cafeteria use.

Energy Saving Performance Contracting

The Arizona Department of Administration, in consultation with Commerce has completed a bid process that has established a pre-qualified list of nine (9) Energy Service Companies. By having a pre-qualified list of companies, agencies, universities and community colleges, K-12 schools and local governments will be able to select Energy Service companies to perform energy-saving projects from a statewide contracts list. This streamlining of the process will reduce the time it takes to have an energy performance contract in place and lead to the completion of more energy-saving projects.

Rising Energy Prices

Reducing energy usage is proving to be difficult for other agencies. There are pressures on their utility budget because of utility price increases. The U.S. Commercial Price for natural gas was $6.50 per million Btu in 2002. This reporting year, natural gas prices peaked at $15.45 per million Btu in July 2009 (137% increase) and retreated to $9.24 in June 2009. This is still a 42% increase in price from FY02. These high natural gas prices caused a ripple effect in fuel costs to electric companies whose electric generating stations use natural gas. Electric utility companies have had to raise their rates as a result of these increases. With more of the agency's operating and maintenance budgets going to pay higher utility costs, fewer funds are left to make energy improvements.

However, there are new programs that could make it easier for agencies and universities to make energy improvements. In addition to streamlining the Energy Performance Contracting process, the Arizona Corporation Commission (ACC) has mandated that Arizona Public Service Company (APS), Tucson Electric Power (TEP), Southwest Gas Corporation (SWG) and UniSource Energy Services (UES) offer a Demand Side Management Programs (incentive/rebate programs) to help their commercial customers make energy efficiency improvements. APS is providing incentives ranging from 10 percent to 50 percent of the cost of an improvement. A large proportion of state facilities are located in APS territory and agencies will be able to take advantage of these incentives. Although not regulated by the ACC, Salt River Project also has incentives for energy efficiency and renewable energy projects.

Department of Commerce Technical Assistance

The Department of Commerce is providing technical assistance to state agencies by benchmarking utility bills, conducting energy audits, and providing training opportunities. Commerce has sponsored training sessions on tracking utility bill histories, energy-efficient lighting and motors, compressed air systems and steam systems. Commerce staff has three (3) LEED Accredited Professionals, a certification program on designing green features of energy efficiency, renewable energy, water conservation and indoor air quality into buildings. ASU has recently launched a $45 million Energy Performance Contract and the Department of Corrections has finalized a $5 million energy performance contract to make energy and water saving improvements to their Tucson prison complex.

Methodology

Two methodologies were utilized to track compliance. First, the agencies were asked to submit the actions they have taken to reduce energy usage and to estimate the amount of energy saved. The second methodology is to track the progress towards achieving the 10 and 15 percent reduction goals by gathering utility data on their buildings. The methodology is to compare the most recent 12 months of utility bills with the 12-month baseline period of July 1, 2001 – June 30, 2002. A.R.S. §34-451 requires the progress report be submitted by July 1 of each year.

Weather and its Affect on Energy Usage

Unusual weather conditions can affect energy usage and measurement in a number of ways. The most obvious is the affect that higher than normal temperatures have on cooling bills. Unfortunately, most cooling equipment operates less efficiently at higher outdoor temperatures. With higher temperatures more cooling is needed, but at higher temperatures cooling equipment is less efficient. Hence, a 10 percent increase in summer temperature can mean a 15, 20 or even 25 percent increase in cooling energy usage.

Weather conditions are important to this analysis because one of the tasks in determining compliance with the law is to compare the energy usage during the baseline period with the energy usage for the most recent 12-month period. Data from the National Weather Service is used in this report to better understand a variable that contributes to energy usage increases or decreases from year to year.

Weather Conditions for Baseline Year and Current Year FY09

To compare weather conditions from year to year, the common methodology is to review cooling degree days and the heating degree days. Degree days are typically compared to a baseline of 65 degrees. A cooling degree day is calculated by taking the high and low temperature for the day, find the average of the two temperatures and subtract 65 from the average. For example, if a day has a high temperature of 100 degrees and a low of 70 degrees. The average temp is 85 degrees. Now subtract 65 degrees from 85 degrees, and the result is 20 and the cooling degree days for this day are said to be 20. Total cooling degree days are kept by day, month and year for comparisons.

The baseline year of FY02 was one of the hottest years on record. Cooling degree days for FY09 were 6% less than FY02. However, July 2008 and May 2009 were considerably hotter than the corresponding months in the FY02. And, May 2009 was the 5th hottest month of May ever recorded in Phoenix. There were 19 days of 100 degrees or higher, tying the record and a 14-day stretch of days with a high temperature at or above 100 degrees, breaking the old record of 13 days.

On heating degree days, FY02 had 870 heating degree days. For FY09, there were 708 heating degree days. That is an 18% decrease in the number of heating degree days. This means that this last winter was warmer than FY02 and required less heating energy to heat state buildings.

Table #1

Cooling Degree Days – Phoenix				Heating Degree Days – Phoenix		
	FY02	**FY09**			**FY02**	**FY09**
July	920	935		July	0	0
Aug	928	873		Aug	0	0
Sept	823	752		Sept	0	0
Oct	452	412		Oct	0	5
Nov	177	104		Nov	68	34
Dec	0	0		Dec	341	278
Jan	0	9		Jan	272	198
Feb	19	33		Feb	115	145
Mar	89	108		Mar	74	25
Apr	359	222		Apr	0	23
May	525	663		May	0	0
June	858	718		June	0	0
Total	**5,150**	**4,829**		**Total**	**870**	**708**

*National Weather Service data for Phoenix through 6/30/09. FY09 had 6% less cooling degree days than FY02 and 18% less heating degree days than FY02.

Concluding Comments on Weather

- There were 6% more cooling degree days in FY02 than in the current year.
- There were 18% fewer heating degree days in the current year than in FY02.
    - Resulting in less energy needed for cooling and heating in FY09 than in FY02.

University Student Population Increases

Although ASU, NAU and UA have taken actions to reduce their energy usage on all campuses, the tremendous increase in the college student population makes it very difficult to compare the energy usage in the university sector over time. The difficulty can be illustrated with the ASU West Campus and Polytechnic campuses. While there has been some square footage of space added to each campus after the baseline period, it was the increase of the student base to the existing buildings – a "filling-out" of the existing campus spaces -- that resulted in large increases in energy usage.

Table #2

Enrollments Fall Semester Full-Time Equivalent						
	ASU Tempe	**ASU West**	**ASU Polytechnic**	**NAU Flagstaff**	**UA Tucson**	**Total**
FY02	41,157	4,387	1,542	17,057	32,460	96,630
FY09	46,595	7,694	5,271	19,537	35,195	114,292
Difference	+5,438	+3,307	+3,729	+2,480	+2,735	17,662
% Increase	+13.2%	+75.4%	+242%	+14.5%	+8.4%	**+18.3%**

Source: Arizona Board of Regents Fact Book – Enrollment History.
This does not include student populations for: ASU Downtown, NAU Yuma or UA South.
Student population was up 18.3% over the baseline period.

Laboratory Facility Additions

Laboratory space uses considerably more energy per square foot than classroom spaces. Laboratories are required to exhaust larger quantities of air to ensure safe working conditions. The equipment in the buildings has higher "plug load" demands. For reporting purposes, the universities have been

asked to separate the energy uses of these new lab buildings from the baseline buildings. If the lab building is not separately metered, it may not be possible to list its consumption separately. The year's report, Polytechnic has new laboratory space that is included in their energy usage numbers. U of A has considerable laboratory space included in their main utility meters. This makes their overall consumption higher than what it would be if labs were metered separately.

Table #3

New Laboratory Space (in Sq.-ft.)*						
	ASU Tempe	**ASU West**	**ASU Polytechnic**	**NAU Flagstaff**	**U of A Tucson**	**Total**
New Laboratory space added since FY02	601,754	94,450	70,000	500,000	593,725	1,859,929

* These numbers presented to show laboratory growth. Some lab space is on the main meters and some lab space is separately metered. Where the space is on the main meter, reductions in usage can be difficult.

Department of Correction System Prison Population

Arizona's growing population has an unwanted result of more individuals entering the prison system. The Department has experienced a 14.2% increase in the inmate population since FY02. With basically the same square footage of prison facilities, the increases in population causes the energy usage on a per square footage basis to increase.

Table #4	**Department of Correction Managed Facilities – Inmate Population**
FY02	27,451
FY09	31,345
Difference	+3,894
% Increase	**+14.2%**

(Note: Energy consumption for Corrections is significantly impacted by inmate population. Another way to analyze energy consumption for Corrections is to look at energy usage from a per capita perspective. If one were to look at Corrections according to per capita energy usage as opposed to a per square foot calculation, the energy reduction is larger than reported. For FY02, the energy usage was 35,871,028 Btus per Inmate. In FY09, the energy usage was 27,479,017 per inmate. This calculates to a **23.3%** reduction in energy use per inmate.)

Building System Reports

Summary of Building System Reductions

Table #5 contains a summary of the energy usage on a Btus per Square Foot per Year for the three building systems listed in ARS 34-451. It has a comparison between the FY02 information and the final information for FY09.

Department of Administration Building System

The ADOA Building System reports a 12.1% reduction in energy usage in FY09 as compared to FY02. There is a considerable range between agencies. Table #6 contains data on the progress made by individual agency. The DEMA had reduced their usage by 11.2%. Much of this reduction was made possible through their federal military partners who share space with DEMA. The other agency savings range from +2.0% to -18.7%. For some agencies, it has been difficult for the agencies to secure the funding necessary to implement projects larger enough in scope to have a significant impact on reducing energy usage. The recent approval of a pre-qualified list for energy saving performance contracting companies is a major step towards implementing comprehensive energy reduction measures. In addition, APS, SRP, TEP, Unisource Energy Services and Southwest Gas Corp. have rebate programs available for energy efficient measures, renewable energy and combined heat and power. On the positive side, three new, large buildings on the capitol complex mall have earned the U.S. EPA's Energy Star© labeled building award (ADOA, ADEQ and DHS). These three building are very energy efficient. However, because they are administered by private companies, the utility data for these buildings is not included in Table # 5 or #6 calculations.

Department of Transportation Building System

ADOT has reduced their consumption by 18.7% from FY02. The department has been very active in participating in utility company rebate programs. In the past two years, the department has received utility rebates for replacing over 350 old thermostats with new, Energy Star rated programmable thermostats. Each thermostat saves over $100 a year. ADOT has received rebates for replacing inefficient lighting and for replacing 44 inefficient packaged air conditioning units.

Arizona Board of Regents Building System

The Board of Regents results are a 3.6% reduction from FY02. A number of factors contribute to the building system not achieving a 10% reduction in energy usage. First, the university campuses have experienced tremendous growth in their student populations since the baseline period. The state system had an 18% increase in students. But on closer review, we see that ASU West and ASU Polytechnic had 75% and 242% increases, respectively. With relatively small increases in square footages on these two campuses, but large increase in student populations, the energy intensity per square footage rose dramatically.

To try and account for the increase in building square footage and the increase in student populations, a calculation can be made to try and factor in these two conditions. In Table #5, the calculation that accounts for the increase in square footage is shown on the second to last line of the table. For FY02, the energy usage for the university system is 130,545 Btus/sq.-ft./year. The energy usage for FY09 was 125,874 Btus/sq.-ft./year. Just as a trend indicator, not necessarily an absolute calculation, we'll divide each of these numbers by their student counts. First, divide 130,545 Btus/sq.-ft./year by 96,630 students in FY02. The result is 1.35 Btus/sq.-ft./year per student. Second, divide 125,874

Btus/sq.-ft./year by 114,292 students in FY09. The result is 1.10 Btus/sq.-ft./year per student. The percentage reduction is 18.5%. This would be an indicator that while square footage and student populations had increased, the energy usage per student is down due to energy efficient actions.

Table #5 (FY 09 data)	Baseline Energy Usage 7/1/01 - 6/30/02	Baseline Energy Usage	Baseline Energy Usage	FY09 Energy Usage (Last 12 months)	FY09 Energy Usage (Last 12 months)	FY09 Energy Usage (Last 12 months)
Building System	**Btu/sq.-ft./year**	**Baseline Square footage**	**Total Btus**	**Btu/sq.-ft./year**	**Square footage**	**Total Btus**
Administration (ADOA)	91,904	3,256,653	299,299,437,312	82,802	3,159,603	261,621,447,606
Corrections	135,653	7,258,930	984,695,631,290	116,508	7,392,887	861,329,792,148
DEMA	46,100	1,554,000	71,639,400,000	40,950	1,710,000	70,024,500,000
DES	72,392	766,250	55,470,370,000	64,246	761,434	48,919,088,764
Health Services (state hospital)	137,154	378,709	51,941,454,186	139,924	566,874	79,319,277,576
DPS	129,757	401,376	52,081,345,632	114,792	432,530	49,650,983,760
Total ADOA System		13,645,072	1,525,042,612,788		14,023,328	1,370,865,089,503
			111,276			97,756
ADOA System Reduction						**-12.1%**
Total ADOT System	58,984	1,637,056	96,559,480,580	47,953	1,653,041	79,268,275,073
ADOT System Reduction						**-18.7%**
ASU Tempe Campus	131,084	8,945,779	1,172,648,494,436	122,392	9,495,916	1,162,224,151,072
ASU West Campus	74,246	607,073	45,072,741,958	68,713	736,951	50,638,114,063
ASU Polytechnic	65,333	567,366	37,067,722,878	58,122	1,115,251	64,820,618,622
NAU	120,870	4,510,390	545,170,839,300	102,861	5,676,037	583,842,841,857
U of A	140,948	10,598,720	1,493,868,386,560	146,073	13,930,217	2,034,828,587,841
Total University System		25,229,328	3,293,828,185,132		30,954,372	3,896,354,313,455
Baseline Total Btus/sq.-ft./year			130,556			125,876
University System Reduction						**-3.6%**

Agency Reports

Agency Summary Table

Table #6 Final Data Building System	Energy Usage Baseline 7/1/01 - 6/30/02 Btu/sq.-ft./year	2008 Target 10% Reduction Btu/sq.-ft./year	2011 Target 15% Reduction Btu/sq.-ft./year	Energy Usage FY09 Estimate Btu/sq.-ft./year	Percent Change FY09 from Baseline
Administration (ADOA)	91,904	82,714	62,249	82,802	-9.9%
Corrections (DOC)	135,653	122,087	115,305	116,508	-14.1%
DEMA	46,100	41,490	39,185	40,950	-11.2%
DES	72,392	65,153	61,533	64,246	-11.3%
Health Services State Hospital	137,154	123,439	116,581	139,924	+2.0%
DPS	129,757	116,781	110,293	114,792	-11.5%
ADOT	58,984	53,086	50,136	47,953	-18.7%
ASU Tempe Campus*	131,084	117,976	111,421	122,392	-6.6%
ASU West Campus**	74,246	66,821	63,109	68,713	-7.4%
ASU Polytechnic***	65,333	58,800	55,533	58,122	-11%
NAU	120,870	108,783	102,740	102,861	-14.9%
U of A****	140,948	126,853	119,806	146,073	+3.6%

* ASU Tempe Campus added 601,618 sq.-ft. of laboratory space after the baseline period. This space is sub-metered and is not included in this calculation. Laboratories use considerably more energy per square foot of space. Including their consumption would skew the data.

** ASU West Campus had 4,387 students in FY02 and 7,694 in FY09, a 75% increase. (Full Time Equivalent)

*** ASU Polytechnic had 1,542 students in FY02 and 5,271 in FY09, a 242% increase. (Full Time Equivalent)

**** The University of Arizona added 593,725 square feet of space in the past year, including high usage laboratory facilities. Laboratories use considerably more energy per square foot of space. The U of A is including their lab consumption in their reporting numbers.

Agency Reports

Arizona Department of Administration (ADOA)

ADOA building system has two major categories:

1. Buildings managed by ADOA for other agencies.
2. Buildings managed by the other agencies.

In addition to the building space ADOA manages for their employees, ADOA manages additional space for their agency tenants including the Departments of Agriculture, Attorney General, Commerce, Corporation Commission, Corrections, DES, Education, Health Services, Juvenile Corrections, Land, Revenue, Supreme Court, and many Boards and Commissions. Energy usage for **FY09 was 9.9**% less than the baseline of FY02.

Actions Taken in FY09	Project Cost	Estimate Annual Savings*
ADOA implemented 3 energy conservation measures at the State Courts Bldg.	$151,500	See below
1. Replaced 34-watt, T12 lamps and ballasts with 25-watt, T8 and electronic ballasts (7,808 lamps)		$66,080
2. Replaced incandescent lamps with cfls (447 lamps)		$6,100
3. Replaced cfl exist signs with LED exit signs (115 signs)		$1,300
ADOA implemented 3 cost-saving measures throughout the Capitol Mall and Tucson State Office Bldgs.	Completed with regular assigned duties no overtime.	These measures will offset a portion of the utility rate increases that occurred in the past year.
1. Reprogrammed the energy management system to refine cooling and heating operation		
2. Installed light switches to enable employees to turn off lights previously controlled by a single circuit		
3. Removed more than 5,300 lamps in 34 bldgs.		Typically, save $7/lamp/yr
Totals	**$151,500**	**$74,480**

* Estimated Savings are for a full year.

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ADOA managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ADOA	91,904	82,714	78,118	82,802	-9.9%

*If one includes the lease to own PLTO buildings, ADOA is at a **16.6%** reduction over the 2002 baseline. ADOA also began an active program to install energy efficient measures in their buildings and use the APS incentive program called Solutions for Business.

Arizona Department of Corrections

The Department submitted a 30-page report containing the utility bill histories for their 10 prison complexes and 1 officer training center. The report covers their 1,436 buildings containing 7,392,887 sq.-ft. of space. Data for the most recent year when compared to the baseline year shows natural gas consumption **down 17%.** Propane consumption is down **44%**. Electricity is down by **8.4**%. Combining these numbers, Correction's energy usage is down **14.1%**. In contrast to other state agencies, the Department's facilities operate 24/7. The result is night and weekend consumption is a greater factor in overall energy consumption than for other state agencies. Their inmate population has grown by 14% since the baseline period. The department has designated an Energy Manager to track utility costs and implement programs and processes to reduce energy consumption. Each prison complex has an Energy Coordinator to lead energy conservation efforts. The Department has entered into an Energy Savings Performance Contract at the Tucson complex. It will be the model to expand to other campuses. Below is an example of the actions taken to reduce energy usage at the Perryville complex. A copy of their report is on file with Commerce. A partial list follows.

Arizona Department of Corrections – Actions Taken*

Actions Taken in FY09*	Project Cost	Quantities
Convert light fixtures to energy-efficient lighting	$82,000	3,100
Install programmable thermostats, occupancy sensors and timers.	$370	10
Install water saving devices	$2,422	226
Replace old A/C units with 11.4 EER A/C, Gas Packs and heat pumps	$47,350	5
Totals	**$132,142**	

* At the submittal deadline, Corrections had only gathered energy actions data for the Florence complex. Data for the other prison sites is being collected and will be submitted for September Final Report.

Arizona Department of Corrections

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
Corrections	135,653	122,087	115,305	116,508	-14.1%

Arizona Department of Economic Security (DES)

DES FY09 electric consumption decreased 14% from our FY02 baseline. A 10% reduction was targeted for FY08 as required by ARS 34-451.

DES has been able to make small reductions in electricity usage by installing more efficient HVAC and lighting systems when existing systems reached the end of their useful life. DES reports that significant changes in the efficiency of DES buildings has not occurred due to the lack of capital funding to install more efficient systems (lighting and AC) in DES buildings. Since the consumption is measured in BTU per square feet, and many FTE changes have happened since FY02, it's hard to quantify the impact that staff changes have had on energy usage.

DES has explored the option of contracting for the replacement of inefficient systems and paying for the replacement through future utility savings but has found the financing impractical at this time.

Actions Taken in FY09	Project Cost	Estimated Annual Savings
Education effort to remind staff to turn off lights and equipment when not in use.	*	*
Install more efficient equipment when unit fails		
Totals	**$**	**$**

*Did not submit cost or savings numbers.

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
DES managed Buildings	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	
	72,392	65,153	61,533	64,246	-11.3%

Arizona Department of Emergency and Military Affairs (DEMA)

DEMA has reduced their energy consumption from 46,100 Btu/sq-ft in FY02 to 40,950 Btu/sq.-ft. in FY09. This is an 11.2% reduction. The sharing of facilities with federal entities has allowed DEMA to use programs available from the federal government. DEMA is currently demonstrating solar photovoltaic systems, wind energy systems and solar thermal cooling systems at their facilities.

Actions Taken in FY09	Project Cost	Estimated Annual Savings
On-going bldg energy audits of all energy using equipment, including the verification of lighting levels: reduced as applicable to OSHA requirements (not to affect security or productivity or safety of employees.) Audits of approx. 10% of DEMA buildings are completed every FY. *	In-house staff – zero cost	$10,000
Continued awareness campaign to get employee involvement (adopting the Governor's Smart Energy Usage Plan). Employees shutting off unneeded lighting and/or office equipment. Program has been expanded by the environmental office, setting up an EMS committee to establish regular site visits and occupant training/ awareness. **	In-house staff – zero cost	$6,000
Continue to raise temperatures to 76-77 degrees in summer months, and lower to 70-71 degrees in winter. (Adjusted/ controlled 24/7 in 33 buildings by BACnet EMCS.)	In-house staff – zero cost	$10,000
Continuous commissioning of HVAC system and central plant for PPMR HQ Facility (M5101). Includes a reconfiguration of piping and automated valves in central plant.	$34,000	$6,000
Integration of BACnet EMCS with occupancy sensors to setback cooling/ heating when rooms show no occupancy after 1 hour. (Several buildings at PPMR currently completed: just beginning to install units at WAATS training site (mostly targeting classrooms and break/ copy rooms).	$3,000	$2,000
Retro-commissioning at Camp Navajo (dining facility and billets: using contract and in-house staff). Project is underway to reduce use of 100% outside air during heating season (with BACnet controls and CO2 sensors to recirculate air). A utility rebate from APS is pending.	$5,500	$1,800
Added 10 KW to existing 50 KW photovoltaic array at WAATS (eg: WAATS Solar Farm). Array is now 60 KW. (Building base load is 90KW - we hope to grow farm to 90KW by 2012).	$64,000	$32,000
Continuous commissioning of WAATS (L4500) Administration Facility; On-going central plant DDC control renovations and adjustments to sequence of operations. (THIS is a "work in progress" and will be	$6,000	$30,000

so for a few more years….)		
DEMA – Continued Actions Taken in FY09	**Project Cost**	**Estimated Annual Savings**
Completed by contract on May 1st of 2009, a 16KW photovoltaic array was installed on our Regional Training Site at PPMR. System was approved for utility rebate from SRP.	$104,000	$2,900
Solar absorption chiller project at PPMR on the DEMA ECO-building. Using solar thermal cooling to cool the ECO-building and almost 1/2 of the Facilities Management Administrative Facility. Partnership with Salt River Project as a demonstration of the new technology. Estimated to provide over 120,000 Btus/hr of cooling from a solar thermal array of heat pipe vacuum tube solar collectors.	SRP has not released final costs (private study being done in progress).	$1,200
Completed super T8 lighting replacement at six DEMA Facilities (in lieu of scheduled group relamp project). 32W T8 lamps and ballasts replaced with 28W super T8s with new high-efficiency programmed start ballasts. Utility rebates are pending from SRP. ****	$9,400	$4,300
Totals	**$225,900**	**$106,200**

- * On-going building energy audits include adjusting settings of ALL equipment (temperature settings, occupancy sensors, photocells, etc)
- ** DEMA has seen a noticeable increase in the number of employees who are actively participating in DEMA's energy program. NEW sustainability
- *** Many DEMA buildings are now operating 16-24 hours per day, with a considerable increase in the number of occupants, due to border security and for continuing support of the mission in the Middle East (computers, admin/training classes and billeting for soldiers and support staff).
- ****Buildings with new super T8 lamps include: L4500, L4525, M5750, M5101, M5230 and M5320. Special DOD STIMULUS funding.

	Baseline Energy Usage 7/1/01 - 6/30/02	**2008 Target 10% Reduction**	**2011 Target 15% Reduction**	**Energy Usage (Last 12 months)**	**Percent Change from Baseline**
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DEMA	46,100	41,490	39,185	40,950	-11.2%

Arizona Department of Health Services (DHS)

- The State Hospital worked with the ADOA to complete the following project. ADOA was the project manager.

Actions Taken in FY09	Project Cost	Estimated Annual Savings
Natural gas hot water heaters and hot water lines repaired.	$18,500	Unknown
Cooling tower modifications and repairs.	$25,822	"
Chiller repairs	$79,606	"
Install new HVAC on Juniper Unit	$4,900	"
Totals	**$128,828**	**$**

At the Department's new office building at 150 N. 18th Ave., a number of actions were taken to reduce energy usage. These actions resulted in the Department receiving the U.S. EPA's Energy Star Building label. It became the third state agency building to receive the award. This building is managed and administered by a private company and therefore, the energy consumption of this building ***is not*** included in the calculations in this report. The department also has considerable office space in 1740 W. Adams. This building is administered by ADOA and the energy data is included in ADOA's report, not in DHS's report.

Arizona Department of Health Services (DHS) (FY08 data)(FY09 data was partial data.)

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DHS	137,154	123,439	116,581	139,924	+2.0%

*

Arizona Department of Public Safety (DPS)

DPS has implemented of numerous energy conservation measures with the net result being only a modest reduction in usage. Despite aging buildings and an exponential increase in use of electronic devices such as computers, printers, consoles, microwave processors, communications, security equipment, DPS has achieved some reduction in usage. An increase in hours of operation and a significant increase in staff have occurred within existing building square footages.

Actions Taken in FY09	Project Cost	Estimated Annual Savings
Install setback thermostats in Scottsdale bldg.	$2,900	$600
	$20,000	$3,727
Replace older modular buildings slated for surplus, with newer, higher efficiency units.	$10,000	$450
Replace approximately 300 T12 lamps with more efficient T8 lamps.	$5,500	$2,300
Replaced 36 incandescent exit signs with LED.	$664	$742
Replaced older A/C units for newer, higher efficiency models (Tucson).	$8.500	$850
Raised chilled water temperature state HQ.	$0	$2,600
Reprogrammed chiller plate and frame heat exchanger	$922	$3,750
Totals	**$48,486**	**$15,019**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DPS	129,757	116,781	110,293	114,792	-11.5%

Arizona Department of Transportation (ADOT)

For the baseline year of FY02, ADOT collected utility bill history for their 91 largest buildings and determined energy usage on a square foot basis. Since that time, ADOT has discontinued use of 4 buildings and replaced 2 buildings for a total of 89 buildings. These changes necessitated a change in the original baseline. This year's report has ADOT's building energy usage 18.7% lower than the baseline in FY02. (ADOT submitted a very detailed list of actions taken, below is a summary of that list. ADOT's full report is on file with Commerce.)

Actions Taken FY09	Quantity of the Action	Estimated Annual Savings
Lighting measures: Convert T12 lamps to T8 lamps, install compact fluorescent lamps	numerous	$56,140
Replaced old thermostats with Energy Star© rated programmable thermostats	52	$7,800
Replaced inefficient heating and cooling packaged unit with energy-efficient package units	15	$7,860
Replaced old roofs or applied new white reflective roof membranes	29	$7,750
Replaced 40 and 30 gallon water heaters with smaller and more efficient units.	5	$450
Install plate & frame heat exchanger	1	$16,249
Other measures		$7,365
Total Annual Estimated Savings		**$103,614**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ADOT Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
FY09 89 buildings	58,984	53,085	50,136	47,953	-18.7%

The data submitted by ADOT is very comprehensive.

* **The following locations were removed from the baseline because operations moved to buildings not in baseline and contributed to the change in values.**

1. FY09 - 2039 W. Lewis replaced 1435 S. Price Road (Mobile Off. - account closed June 2008)
2. FY09 - 114 E Western replaced Valley West Construction (5961 w. Myrtle) account to be closed in April.
3. FY09- The square footage was revised for Old MVD - it was noted that an additional 12,960 sq ft for the four modular buildings.

The Arizona Board of Regents (ABOR)

Arizona State University Tempe Campus

An Energy Saving Performance Contract provides ongoing energy conservation through the improved performance of thermal systems and buildings. All new campus buildings are being designed to ensure energy efficient performance; Biodesign Building B has been awarded LEED Platinum certification. Biodesign Building A, and Interdisciplinary Science and Technology Building, have been awarded LEED Gold certification, while Interdisciplinary Science and Technology Building 2 was recognized with LEED Silver certification. Installed 3,590 kW of Solar generation across the campus.

Actions Taken FY09	Project Costs	Estimated Annual Savings
Utilization of performance contract operations Phase 1	$34,000,000	$3,834,000
Lighting: re-lamped 40 buildings from T8-32w to T8-25w	$473,129	$50,455
Test Application at Biodesign Building B of demand ventilation for use in all laboratories	$50,000	$75,000
Biodesign Building A & B demand ventilation & zone presence sensors for use in all laboratories	$2,933,891	$738,671
Retrofit Interior Lighting in 17 Buildings to 25 W T8	$360,872	$52,961
Replaced 55 defective Steam Traps	$97,189	$163,791
Partial completion of VAV & DDC upgrade	$757,108	$120,115
Installed 150 kW PV system on Bio Design Buildings	$1,723,094	$23,571
Installed PV systems on PS #1, #5, and Lattie Coor Bldg	$16,430,689	
Adjusted cooling and heating set points to 80 deg & 65 deg respectively	$2,400	$420,000
Total	**$58,323,250**	**$5,216,963**

Arizona State University Tempe Campus

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ASU Tempe Campus	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ASU Tempe	131,084	117,976	111,421	122,392*	-6.6%

* Excludes new research laboratory space added since the baseline, of 601,618 sq. ft. that consumed 280,754 MMBTU. Laboratories use considerable more energy than classroom or office buildings. Adding the laboratories to the baseline would skew the numbers and hide any savings. Includes: Biodesign A & B, Interdisciplinary Science and Tech 1 & 2, and Research Support Services 5.

ASU West Campus

- Since the baseline year of FY02, the student population in Full Time Equivalent (FTE) has increased 75% from 4,387 to 7,694 students in the fall of 2008.
- In June of 2005, operating hours were changed on the original Classroom Laboratory Building from 4,234 hours per year to 8,760 hours per year. With these two facilities, the total square footage operating is at 8,760 hours per year. This increase in operating hours has added an estimated increase of 2,013,300 kWh per year at the buildings and central plant. This additional usage costs $134,764 per year. There has been an increase in Btus per square foot.
- Site lighting to all parking lights are powered from the existing building systems, which has been part of the Btus per square footage calculation. Additionally, in 2005 a new parking lot with site lighting was added, which is powered from existing buildings. Actual cost and usage has yet to be determined.
- Since the baseline year of FY02, ASU West has increased the number of hours for classroom utilization from the typical Monday – Thursday operation. Now there are classes Monday – Friday and additional classes on Saturday each week. The additional load has been trimmed though effective upgrades of the campus wide controls, which has provided for a more precise control of all buildings.

Actions Taken FY09	Project Costs	Estimated Annual Savings
In 07-08 energy management upgrades were completed in FAB & UCB. During the past year in house staff have evaluated all spaces and written custom programming to trim operating hours and operating parameters. Reducing building electrical usage.	In-house staff	$29,424
High pressure cleaned air side of chilled water coils UCB & FAB. Work was completed using a system that can change from 0 PSIG to 2,500 PSIG without any damage to coils. Improved air flow and heat transfer causing a decrease in utility usage.	$4,900	$16,500
Improved boiler operations by writing custom programming that looks at outside air conditions, indoor conditions and building in Sands and CLCC II. Reduced hours of operation by 30%.	In-house staff	$12,500
Total	**$4,900**	**$58,424**

ABOR managed buildings	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ASU West buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
Total	74,246	66,821	63,109	68,713	-7.45%

ASU Polytechnic Campus

Through an energy saving performance contract, ASU at the Polytechnic campus has been actively monitoring the performance to several of their buildings. Currently the Polytechnic campus is in its fifth year of the performance contract. To enlist the support of staff and students, the Energy Conservation Committee has a campus-wide awareness campaign that includes a website, an energy hotline and articles placed in campus newsletters. Three new building complexes, totaling 250,000 square feet, were designed and built to Silver LEED certified standards. These buildings have been performing as designed and serving both environmental and energy conservation efforts. It should be noted that approximately 70,000 square feet is for research and new academic labs. Scheduled for the next fiscal year, one more building will be brought on line adding to the growth of the facilities.

The Polytechnic campus is in a growth state and the energy usage will vary until it establishes its consistent baseline of student population. In FY02, the student population was 1,542 with 567,366 of operating square footage. For FY09, the Polytechnic campus has a student FTE population of 5,271 with 1,115,251 of operating square footage. The student population is up 242% over the baseline year. With the introduction of several new facilities, the campus has experienced longer hours of operations due to additional course offerings, based on student demand. Through administrative edicts and daily monitoring, the Polytechnic campus has stayed proactive with sustainable initiatives and conservation efforts. The results of the calculations from the baseline year, demonstrates a yield of an 11% reduction.

ASU Polytechnic - continued

Actions Taken FY09	Estimated Project Cost	Estimated Annual Savings
Monitoring savings of performance contracting measures of lighting retrofits, HVAC equipment and chiller replacement.	$2,500,000	$172,971
Energy reduction mandated by ASU administration (Cooling set point 80 degrees, heating set point 68 degrees	minimal	TBD
Strategic changes to utility bill rate schedule	Staff labor	$49,714
Exterior lighting added to the EMS	$10,000	Undetermined at this time
Total	**$**	**$218,560**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ASU Polytechnic	65,333	58,800	55,533	58,122	-11%

Northern Arizona University (NAU)

In FY09 NAU has continued to grow at a rapid pace. An additional 597,214 square feet has been added to campus. All new construction was built to LEED standards. The new buildings were all connected to the campus district energy system with the exception of a 20,000 square foot warehouse. Heating and cooling can be produced much more efficiently at the central plant then by stand alone units in individual buildings.

The student population has also continued to grow. In FY02 there were 17,057 FTE students. In FY09 there were 19,537 FTE students, an increase of 14.5%.

In addition to building highly energy efficient new buildings NAU has completed many infrastructure upgrades. Two 1,000 ton chillers were added to the North Central Plant. This additional capacity allowed for the expansion of the North Campus chilled water system and the removal of five stand alone chillers. The five chillers that were removed totaling 390 tons of cooling used 2.2 kw of electricity per ton of cooling produced. Cooling provided by the North Central plant is produced for 0.6 kw per ton.

The NAU Office of Sustainability has teamed up with Capital Assets and Services and the Utility Department to get a conservation message out to the campus community. With the University budget cuts there have been many behavioral based energy savings suggestions sent out to campus. All employees were directed to lower temperatures a few degrees in the winter months and raise temperatures or forgo cooling completely in the summer months. Day lighting is being used wherever possible. Lights and computers are to be completely shut off anytime an office space is empty for an extended period of time. Monthly utility usage data has been provided to Campus employees as an incentive for reductions. The following is the NAU data.

	Baseline Energy Usage 7/1/01 - 6/30/02	**2008 Target 10% Reduction**	**2011 Target 15% Reduction**	**Energy Usage (Last 12 months)**	**Percent Change from Baseline**
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
NAU	120,870	108,783	102,740	102,861	-14.9%

Flagstaff experienced a mild winter that greatly reduced the amount of natural gas consumed. A mild spring reduced chilled water demand and the amount of electricity consumed. The roughly 550,000 square feet added to the campus utility footprint between FY02 and FY08 was largely laboratory space which has a much higher energy demand then the dining and residence hall space added between FY08 and FY09.

Compared to the FY02 baseline period, NAU has reduced their energy consumption by 14.9%. To reach the July 1, 2011 goal of a 15% reduction, NAU needs to reduce consumption by another .01%. The North Central Boiler Plant is going to have two new 50,000 pound per hour boilers installed in FY10 bringing the efficiency of the plant up from 65% to 84%. This installation will help NAU get to the 15% goal.

University of Arizona

The University of Arizona has implemented numerous strategies to reduce and conserve energy usage and costs. As noted in the data below, the number, size and effects of the implemented projects provide knowledgeable indicators of the University of Arizona's commitment to energy and cost savings for its customers, the community and the State. The University diligently strives to exceed the ten and fifteen percent mandatory reductions. The Btu/sq. ft/year is based on the energy calculations from July 2008 through June 2009.

	Actions Taken	Project Costs	Estimated Annual Savings
1	Installed a new 12,000 ton cooling tower at the Main Campus Plant to replace the older, less efficient towers. The west towers (#7 and #8), were originally installed in 1967 and 1973, and the east towers were built in 1981.	$8,700,000	~$578,700 per year
2	Holiday shutdown chilled water and electricity savings from December 24, 2008 through January 4, 2009	n/a	$129,952
3	Reduced the overall DP by two more pounds on the district chilled water system.	n/a	$25,146/year
4	Twenty-five additional standard flushometer style urinals were replaced with new waterless fixtures, during the past fiscal year, bringing total replacement to date to over 325 units across campus.	$19,875	total projected annual savings to $25,914
5	Replaced 104 steam trap	$21,112	$312,000
6	Recommissioned the HVAC system of an entire wing on the 3rd floor of Arizona Health Sciences Center	$4,350	Increase efficiency by 20 to 25%
7	Mechanical Rooms in four campus buildings received wall to wall refurbishment, including heating hot water and domestic hot water systems and related components such as heat exchangers, valves, piping, insulation and system controls, with each component either rebuilt, replaced or calibrated, recommissioning the entire system to re-establish original design parameters and systemic efficiency.	$128,000	Increase efficiency by 15 to 20%
8	Expanded Campus wide Air Handler Scheduling Program during FY 08-09, yielding a current projected annual utility dollar savings of $1,269,063 in related fan horse power.	$14,280	$1,269,063
9	An HVAC Building Controls Retrofit Project included six campus buildings.	$32,984	An Estimated Annual Reduction in Fan Related Electrical Consumption of 20%
10	The USB Building on campus received major modifications to the Building Energy Management HVAC System	$26,456	Reduction in Electrical Consumption of 25%
11	Four large aging/inefficient rooftop package A/C units, totaling 28 tons of refrigeration, were replaced with new high efficiency units equipped with Economizer Systems for free cooling optimization and digital, 7-day programmable thermostats, on a large stand alone campus building	$60,000	Reduction Electrical and Natural Gas Consumption of 25%

12	Smart Classroom" Energy Program, which was developed and implemented during FY 07-08, 15 additional classroom conversions	$12,000	Reduction in Individual Classroom Energy Usage Related to HVAC: 50-75%
	Totals	**$9,019,057**	**$2,340,775**

University of Arizona (UA)

	Baseline Energy Usage 7/1/01 - 6/30/02	**2008 Target 10% Reduction**	**2011 Target 15% Reduction**	**Energy Usage (Last 12 months)**	**Percent Change from Baseline**
U of A managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
U of Arizona	140,948	126,853	119,806	146,073	+3.6

The University of Arizona Campus utility serves an additional 271,900 square feet on the campus grid for FY 2008-2009. The new buildings include the ICA expansion of the Mary Roby gymnastic facility, Richard Jefferson practice facility, Hillenbrand Aquatic Center expansion, along with the UMCC bed tower expansion.

Facilities Management (FM) has a contract with a new natural gas provider, which has saved an average of 30 cents a therm for boiler gas and an average of 11 cents per therm for turbine gas. FM has seen a $330,000 average monthly savings since February 1, 2009.

Appendices

Copy of A.R.S. §34-451

34-451. Energy conservation standards for public buildings

A. The department of commerce in consultation with persons responsible for building systems shall adopt and publish energy conservation standards for construction of all new capital projects as defined in section 41-790, including buildings designed and constructed by school districts, community college districts and universities. These standards shall be consistent with the recommended energy conservation standards of the American society of heating, refrigerating and air conditioning engineers and the international energy conservation code.

B. The standards shall be adopted to achieve energy conservation and shall allow for design flexibility.

C. The following state agencies shall reduce energy use in public buildings that they administer by ten per cent per square foot of floor area on or before July 1, 2008 and by fifteen per cent per square foot of floor area on or before July 1, 2011, using July 1, 2001 through June 30, 2002 as the baseline year:

1. The department of administration for its building systems.

2. The Arizona board of regents for its building systems.

3. The department of transportation for its building systems.

D. The state energy office shall provide technical assistance to the state agencies prescribed in subsection C of this section. On or before July 1 of each year, the state energy office shall measure compliance with subsection C of this section, compile the results of that monitoring and report to the speaker of the house of representatives and the president of the senate as to the progress of attaining the goals prescribed in subsection C of this section. The state energy office shall include in its report an explanation of the reasons for any failure to achieve energy reductions in specific building systems as prescribed in subsection C of this section.

E. All state agencies shall procure energy efficient products that are certified by the United States department of energy or the United States environmental protection agency as energy star or that is certified under the federal energy management program in all categories that are available unless the products are shown not to be cost-effective on a life cycle cost basis.